

U.S. Serial No: 10/551,785
Response to Non Compliant Action of February 25, 2009
Atty Docket No: 124165.00101



ROTATING PISTON MACHINE

Field of Invention:

[0001] The present invention relates to a machine with the revolving piston, which encloses workspaces with alternately changing volume such as: compressors, pumps, or engines where the piston is arranged inside the cylinder formed by two sidewalls and the curved covering, the curve of which is a geometrical locality of the piston cusps arised during its revolving motion around two revolving axes, whereas a conducting ring embedded on the sidewall or rotary in the sidewall or also in a sliding way against a supporting shaft is connected with the piston embedded on the supporting shaft either in a sliding way normal to its axis or rotary through the supporting eccentric connected to the supporting shaft.

Background to the Invention:

[0002] There are known arrangements where the piston holds a simple revolving motion. It is eccentrically placed inside the circular covering equipped by the extension seals, which fill changing distances between the piston and the circular covering and concurrently enclose changing workspaces between the piston and the cylinder covering. This arrangement does not tolerate high pressure or temperature therefore it can only be used as a blower. Furthermore, there are known arrangements where the piston holds one compound revolving motion i.e. rolling motion (by rolling a bigger circle, for example the central circle of the inside tooth-wheel, over an immobile smaller circle for example the central circle of the tooth-wheel with an internal gearing, by means of the tooth-wheels). The diameters ratio of both circles quantifies the number of the piston cusps, which follows the same curve and also the same number of workspaces enclosed by the piston. If the ratio is 2:1, the piston has two cusps and encloses two workspaces. If the ratio is 3:2, the piston has three cusps and encloses three workspaces etc. At the higher number than two of the piston cusps, the covering curve has very inconvenient shape for a combustion space and in addition the biggest-the smallest volume ratio of the workspace is principally restricted, which is the disadvantage of this solution. Two cusps

arrangement can else provide more convenient combustion space and more convenient the biggest-the smallest workspace ratio, but also principally gives the adverse ratio of piston surface encumbered by work pressure to the biggest possible critical shaft diameter, which the piston is embedded on. This arrangement is therefore not suitable for engines, but only for blowers or pumps and low work pressure compressors.

[0003] There is another known concept of the piston with two cusps motion, where both of the cusps follow a curve called conchoid. In this concept, the piston is embedded in a sliding way on two parallel shafts normal to their revolving axes. Herewith, the piston sliding motion toward the individual shafts are mutually perpendicular. One of these shafts acts as a supporting shaft and the other as a conducting shaft; herewith both of them are always embedded just in one sidewall. One of them is adapted in a tubular jig way, which passes through the other shaft, in order to embed both of them into both sidewalls.

[0004] According to other known concepts one of the shafts can be replaced by one or by number of pivots protruding from the piston is embedded on, can also be replaced (in other concepts) by the shaft with the crank pivot, which the piston is embedded on, herewith the conducting shaft, as mentioned above, is replaced by the pivots. These conchoid concepts also have common disadvantages such as, insufficient bearing capacity of the supporting shaft and an inaccurate piston guide sensitive to wear. These construction concepts have not therefore been seen and stayed in the conception state even though they have been well known since the beginning of the 20th century.

Summary of the Invention:

[0005] The present invention seeks to eliminate the disadvantages of the current state of technology by a machine with the revolving piston embedded in the cylinder. This machine is characterized by a piston, which is embedded on the supporting shaft either in a sliding way normal to the supporting shaft axis or rotary through the supporting eccentric connected to the supporting shaft. This piston is connected in a sliding way to, at least, one conducting ring, which is embedded on the sidewall or rotary in the sidewall, or optionally in a sliding way towards the supporting shaft normally to its revolving axis. Another aspect of the present

invention is that the conducting ring is on its front side indisposed from the piston, perpendicularly to its sliding connection with the piston, connected to the auxiliary glide, which is embedded in a revolving way on the conducting eccentric set to the supporting shaft in a parallel way to the supporting eccentric and rotated by 180 degrees. Where two or more cylinders are arranged one next to the other, the auxiliary glide is formed by the adjacent cylinder piston; herewith the directions of the conducting ring gliding connections towards the individual pistons are normal one to another. According to the last aspect, and of the present invention's significance is that spaces between the sliding elements e.g. sockets or nocks, eventually supporting sliding element on one side and the gliding elements, with advantageous casing or groove on the other side are enclosed and equipped by the vents for inlet and outlet of the lubricant.

Detailed Description of the Drawings:

[0006] The present invention can be more readily understood by the Drawings, in which:

Fig. 1 is a schematic of the present invention;

Fig. 2 shows the main aspect of the conchoid design in accordance with the present invention;

Fig. 3 shows another embodiment of the present invention where the piston is conducted by the conducting rings and is further embedded on the supporting eccentric, which is connected to the supporting shaft;

Fig. 4 and Fig. 5 show alternative schematics of the embodiments of the present invention; and

Fig. 6 shows a sectional view of another variation of the present invention.

Detailed Description:

[0007] In Fig. 1, the piston 2 equipped by the slots 3 and 4, which form the sliding elements of the piston 2 is arranged in the curved casing 1. The slots 3, 4 settle the piston 2 on two conducting elements 5, 6, which are always fixed upon one of the shafts 71, 81 whose axes are parallel. According to Fig. 2 the cylinder casing 1 is enclosed by the sidewalls 11, which shafts 71, 81 are rotary embedded on. Arrangements of the sliding elements 3, 4 and the

conducting elements 5, 6 (at the opposite sides of the piston) and shafts 71, 81 is shown on the Figs. 4 and 5. During the revolving of the pistons 71, 81, the fixed conducting element 5,6 (which furthermore revolves the piston through the particular sliding element, e.g. slot) concurrently revolves too. The piston also revolves around the axes 8, 7 through its second sliding element 4, 3, second conducting element 6, 5 and second shaft 81, 71. If the cusps have the same distance from the centre of the piston 2, then both of them follow the same covering curve, which together with connection of both cusps forms two separated spaces.

[0008] The concurrent revolving motion of the piston 2 around the parallel axes 7, 8 causes that during motion along the covering 1 one of the joins of the piston 2 and covering 1 departs, while the other join approaches the covering 1. During revolving around 180 degrees, the space between one join of the piston cusp and the covering 1 amplifies from minimum to maximum while the space between the other joins diminishes from maximum to minimum. If the cylinder covering 1 and/or the cylinder sidewalls 11 are equipped at one side by an inlet and at the opposite side by an exhaust of the liquid or fluent medium, then this medium begins by revolving of just one of the shafts expels from the space between the covering 1 and the piston 2 at one side and sucks out of this space at the other side. The machine then works as a compressor or a pump. If the pressure medium is fed through one side of the cylinder into the space between covering 1 and piston 2 then the pressure on the surface restricted by the join of the cusps and width of the piston 1 causes force, which eludes the revolving axis 7 and causes a moment to this axis. This moment revolves the shaft 71 and thereby also revolves the piston 2 and the second shaft 81.

[0009] In one particular embodiment of the present invention, just one of the shafts 71, 81 is used as a supporting element embedded in the sidewalls 11, while the other is replaced by the conducting ring 72, 82, which is also rotary embedded in the sidewall 11 and which is also equipped by the conducting element 51, 61 connected to the sliding element 31, 41 in the cylinder 2. According to another embodiment of the present invention, the piston itself is rotary embedded, for example, through a bearing on the supporting eccentric 10, which is arranged on the supporting shaft 91 rotary embedded primarily in both of the sidewalls 11. The supporting shaft 91 passes through the conducting rings 72, 82 and its axis lies on the plane formed by axes 7, 8 of the conducting rings 72, 82 in the middle distance between them. Eccentricity of the

supporting eccentric 10 is equal to the middle distance between axes 7, 8. Within the revolution of the piston 2 conducted by the conducting rings 72, 82 the centre of the supporting eccentric 10 moves along the same trajectory as the centre of the piston 2. Piston 2 loading is then fully transmitted by the supporting eccentric 10 and by the supporting shaft 91, so the conducting rings 72, 82 are not under the load of piston pressure. There can be transmitted high piston pressures according to the embodiment shown in Fig. 3 in accordance with the present invention.

[00010] According to the present invention in the firstly described aspect of the conducting shaft 71 adapted as a supporting shaft, it is possible to embed the conducting ring 72, 82 in the sidewall 11, or on the sidewall 11 and also simultaneously in a sliding way against the conducting shaft 71 adapted as a supporting shaft. This sliding design can also be made both on, or in the sidewall 11 and together with this sidewall 11. In this case, the supporting shaft 91 or the eccentric 10 can not be used. Piston loading is then transmitted by the sufficiently dimensioned and both sides embedded shaft 71. By variation of the distance between conducting ring 72, 82 axes and the conducting shaft 71 made as a supporting shaft, there can be fluently, during a machine run, changed both, the ratio of minimal-maximal space between the cusps join and curved covering (and thereby also the volume of the sucked and compressed medium) and also the magnitude of the moment to the revolving axis 7. With an assemblage of, at least, two in this manner machines according to the present invention can be arranged, for example, one as a pump and a second as an engine powered by fluent or liquid medium, both the ratio of revolutions and the ratio of moments of both together connected machines fluently changes during shifting of the conducting ring 72, 82 against the shaft 81.

[00011] Regarding the supporting eccentric 10 and the supporting shaft 91, there is, according to the present invention, a connected function of both of the conducting rings so that the conducting ring 72, 82 is arranged just at one side of the piston 2 and adapted according to the Fig. 6 so that, aside from the conducting element 51, 61, arranged at the inclined cylinder side, it has, along the disinclined cylinder side, ancillary conducting element 52, 62, which the glide rotary set on the ancillary eccentric 15 is in the sliding way embedded in. This ancillary eccentric 15 has the same eccentricity as the supporting eccentric 10 and it is firmly arranged on the supporting shaft 91, which is rotated by 180° against the supporting eccentric 10. In this way, both of the conducting rings can be jointed into the one from both of the embedded sites. It

is clearly seen that from manufacturing reasons, it is more convenient to place the jointed conducting ring on the place of the conducting ring 82 i.e., so the conducting element 61 would be embedded in the sliding element 41 of the piston 2, in a sliding way, perpendicularly to the line joining both of the pistons 2 cusps.

[00012] All machines with moving components have many places, which are necessary to lubricate or to cool. With the machine, according to the present invention, it is not necessary to use a separate pump, because it is possible to use, according to the present invention, changing spaces between some mutually moving parts (e.g. between sliding elements 3, 4, 31, 41, or optionally between the glide 14 and the conducting elements 5, 6, 51, 61, 52, 62 as a pump for a lubricating and/or cooling medium by means of closing these spaces at the sides so that they provide inlet and exhaust vents for the above mentioned medium.) In this manner, not only the usual expensive and heavy pumps can be excluded, but this lubricating, or/and cooling medium can be during pumping inside the machine conducted through places to be cooled, or/and lubricated so that the consumption of these mediums is very small.

[00013] The present invention is, both according to the embodiments described above and in comparison to the known piston engines of the prior art, more convenient by its smaller size as compared to engines with sliding pistons, smaller weight and is totally balanceable. It is more powerful and less noisy compared to the toothed machines. The present invention also provides better force transmission and smaller lubricant consumption as compared to machines with the piston rolling by means of gears. The present invention also provides more accurate piston conduction and better force transmission comparing to other conchoidal machines and finally it also provides a possibility to smoothly change maximal volume of the workspace contrary to all other mentioned machines. With the machine, according to the present invention, there is no direct dependence of the piston diameter on the loaded area of the piston, which enables a utilization under high pressure e.g. in the case of combustion engines, or in the case of very high pressure at hydraulic pumps.